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| TOC | Preface | Chapter1 | Chapter2 | Chapter3 | Chapter4 | Chapter5 | Chapter6 | AppendixA | AppendixB | AppendixC | AppendixD | AppendixE | AppendixF | AppendixG | AppendixH | image022 | image023 | Image3-1 | Image_G-1 | ALL |

CHAPTER 5: Construction

This chapter provides guidance for the construction phase (see Figure 5-1, Construction Checklist, for a graphic presentation of the construction process) of the facility acquisition cycle that includes the following:

a. Obtaining project approval (NASA Form 1509, Facility Project-Brief Project Document) and funding (NASA Form 506A, Resources Authority Warrant) or authority to advertise prior to receipt of funds,

b. Coordinating the advertisement and award of the construction contract with the CO,

c. Managing the construction contract to ensure the facility is constructed in accordance with the contract utilizing constructability principles,

d. Preparing O&M instructions; RCM, PT&I, and CMMS information; and as-built drawings,

e. Final inspection and acceptance of the facility construction work (utilizing the Reliability Centered Building and Equipment Acceptance Guide,

f. Preparing real property vouchers and transfer documents, and

g. Final project closeout.

5.1 Construction Management Considerations

5.1.1 This chapter explains various project management methods and requirements associated with successful completion of a NASA Facility construction project. The methods presented are not all inclusive, and all methods do not apply to every project. The methods are provided as a reference to help NASA project managers successfully execute their programs.

5.1.2 Although facilities projects vary widely in scope and cost, basic management concerns apply, including the tracking, analysis, and reporting of project status and costs in accordance with the management plan described in paragraph 3.22, Facility Project Management Plan. More complex or larger projects require more involved construction management methods. Each project requires exercise of professional judgment regarding the extent to which techniques for monitoring, controlling, and reporting are advisable and cost-effective. The following factors should be considered as a minimum:

a. Dollar value of the work package,

b. Physical interfaces with other packages,

c. Unique construction criteria or techniques,

d. Need for special construction milestones,

e. Use of liquidated damages,

f. Joint occupancy during construction,

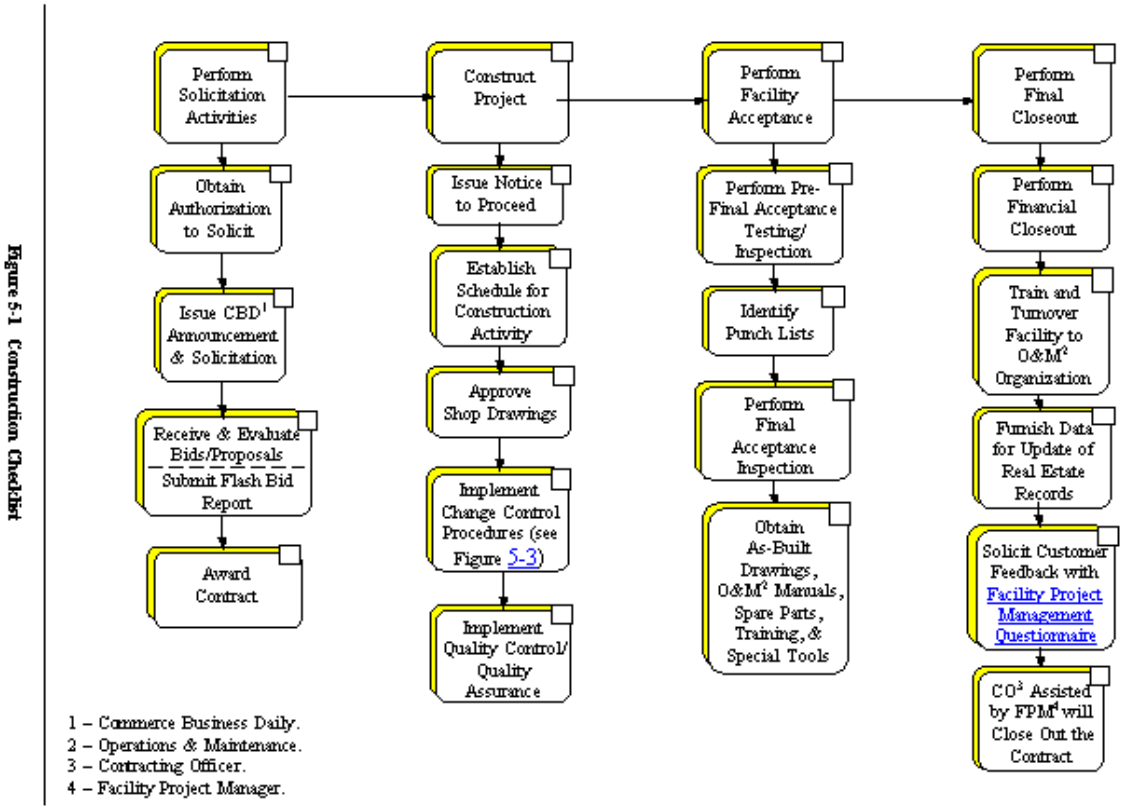

Figure 5.1 Construction Checklist

g. Project criticality to program,

h. Potential bidders' past performance experience,

i. Safety, occupational safety and health-related environmental factors,

j. Quality assurance and/or inspection method, and

k. Availability of GFP.

5.2 Bid Package

The final PAR insures that the bid package is complete and (see paragraph 4.7) includes the following documentation required for advertising the construction contract:

a. Final design drawings, specifications, work descriptions, and procedures,

b. Cover letter to issue the solicitation and general provisions,

c. Special work conditions (see paragraph 4.7.3.2, Special Work Conditions). (These should be emphasized at the prebid conference.),

d. Government cost estimate (sensitive, controlled information),

e. List of GFP, including schedule showing location, condition, status, and date the GFP will be transferred to the contractor's control. This list shall also include procedures that require action by the contractor to protect and account for the GFP,

f. A schedule that provides a time-phased logical sequence of activities and events that are to be accomplished and milestones to be achieved by the contractor, and

g. A PR providing project funding or other documentation such as a planning procurement request.

5.3 Authority to Advertise

5.3.1 No discrete or minor facility project which requires Headquarters approval may be advertised (invitation for bid or request for proposal) prior to approval of the NASA Form 1509; or the receipt of specific authorization from the Headquarters Director, Facilities Engineering Division.

5.3.2 Funds and/or authority to advertise prior to receipt of funds may be requested when the final design is 90-percent complete and the following are, or have been, provided as appropriate:

a. For discrete projects over $5,000,000 and others as specified by the Headquarters Director, Facilities Engineering Division, the following are required:

(1) Current NASA Forms 1509 and 1510,

(2) A locally approved Facility Project Management Plan as described in paragraph 3.22, Facility Project Management Plan, and

(3) A PAR checklist (see paragraph 4.7).

b. For all other discrete projects, current NASA Forms 1509 and 1510,

c. For minor projects, current NASA Forms 1509 and 1510 as required by Headquarters, and

d. For projects funded from other than CoF appropriations, current NASA Forms 1509 and 1510 and assurance that the Center has project funds or authority for the project.

5.3.3 Governmentwide Point of Entry (GPE).

5.3.3.1 Discrete facility projects may be synopsized in the GPE after receipt of Headquarters approval of the NASA Form 1509 or specific authorization from Headquarters to proceed.

5.3.3.3 Minor facility projects may be synopsized prior to receipt of Headquarters approval.

5.3.4 The Headquarters Director, Facilities Engineering Division, may authorize the continuation of the solicitation process on discrete projects up to and including the receipt of bids or proposals prior to the release of funds and subject to the Center procurement officer's approval. This is the case, for example, when a discrete project involves various work packages, each of which comprises only a portion of the overall approved scope.

5.4 Construction Contracting

5.4.1 The FPM and CO should agree on the acquisition strategy (including contract type, contract administration plans, and source evaluation method) prior to advertising the project.

5.4.2 The issuance of the construction contract is the responsibility of the procurement office. The FPM and the CO are responsible for the following:

a. Final review of the documents by all appropriate personnel,

b. Advertisement of the package in a timely and legal manner to ensure maximum competition and responsive bids,

c. Coordination of site visits and briefings for prospective bidders and responses to questions,

d. Receipt and evaluation of bids or proposals,

e. NASA Flash Bid Report (Form 1579),

f. Contract award,

g. Notice to proceed,

h. Understandings with the contractor for such items as payment schedule and shop drawing review, and

i. Liquidated damages. (FAR 11, Subpart 11.5), Liquidated Damages, states when a CO may use liquidated damages clauses in a contract.)

5.4.3 Construction Management Agents. In some instances, because of limited in-house resources, it may be desirable to use an outside agency to manage all or a portion of the acquisition of a facility. The available sources are as follows:

a. A contract for services with a construction management firm, and

b. Services available from other Government agencies.

5.4.3.1 In either of the above cases, the decision should be made early and the appropriate funds included in the project budget. The other Government agencies must be reimbursed for the services rendered, and contracting with them requires approved funding. The decision to use an outside agency for all or some part of the services associated with acquisition of a facility may be due to other factors rather than simply a lack of human resources. Specialized or unique design/construction requirements or a remote construction site are two possibilities. The decision for use of one of the other Government agencies or a commercial contract must be based on considerations of the following:

a. Cost,

b. Availability,

c. Necessary expertise, and

d. Responsiveness to NASA management's needs.

5.4.3.2 In all instances, the use of construction management services must include careful evaluation of the proposer's qualifications plus preparation of a specific and comprehensive Statement of Work (SOW).

5.5 Acquisition Process

5.5.1 The two basic procurement methods are sealed bidding and negotiation. During the acquisition process, NASA solicits offers, evaluates bids or proposals, and awards contracts. The solicitation consists of a statement of work and/or drawings and specifications, which describe the requirement, contract clauses, and solicitation provisions. IFB's are used when contracting by the sealed-bidding method and the award is made to the lowest responsive and responsible bidder on the basis of the bid price only. An RFP is used when contracting by the negotiation method when award is based not only on price but also on other factors such as technical ability, schedule, and relevant experience and past performance.

5.5.2 The following are variations to the sealed-bid and negotiated procurement methods:

a. Design-Build. These projects can be obtained through an RFP or IFB process. An SOW without specifications or drawings is provided whereby the contractor is responsible for design and construction of the project. This process is used when the project requirements are firm and the project is not of a highly technical nature. This process usually eliminates a large volume of change orders and places the majority of the risk on the contractor through use of a ceiling price. See FAR Part 36, Subpart 36.3,

Two-Phase Design-Build Selection Procedures, for procurement details.

b. Design-Furnish-Install. These projects are usually negotiated through an RFP process. The solicitation package generally includes an SOW, specification, and layout of the facility. The contractor shall design, fabricate, and install the specified equipment as a final deliverable item. This method is normally utilized for an equipment related project such as the installation of a crane.

c. Two-Step. This process is an RFP. A two-step procurement includes Step 1: submission of a technical proposal and NASA determines the acceptability of each technical proposal; and Step 2: submission of bid price from each prospective contractor deemed acceptable in Step 1. The low bidder in Step 2 is usually awarded a firm fixed-price contract. This process is used for projects of a highly technical nature requiring specific knowledge or technical expertise.

5.5.3 The timing of the advertisement for bids is critical to receiving responsive bids at a favorable price to NASA. Adequate time for prospective bidders to analyze the work and prepare a competitive cost figure is essential. For small or straightforward project scopes, a 30-day bid period is usually adequate. Generally, these types of projects attract local contractors who are familiar with both the installation and local labor and material costs. For projects that are large or complex, the bid period usually should be extended to 60 days or more. The advertisement should also be directed beyond the local area to attract other than local bidders and to increase competition. Besides the time and amount of advertising exposure given the IFB, other factors that can significantly affect the bids received are the following:

a. If the local construction activity is depressed, competition should be greater. If significant construction activity is occurring, expect less competition.

b. If certain materials and/or equipment are limited because of high demand, expect inflated prices and assess schedule impacts.

c. If local labor costs are uncertain because of pending union contract negotiations and attendant problems, expect higher and fewer bids.

d. If the contract special conditions or requirements impose unusual constraints on the contractor's management flexibility, expect higher bids.

e. If the project includes specialties or trades not locally available, expect higher bids.

5.5.4 The items above generally are not controllable by the FPM. In some cases, if the conditions are recognized ahead of time, actions may be taken to reduce or offset unfavorable impacts. For example, in case of union contract problems, delaying issuance of the IFB or extending the response date beyond the likely resolution date may be warranted.

5.5.5 Contracting Officer's Responsibilities

5.5.5.1 The FPM must fully recognize that only the CO is authorized to enter into or modify contracts for supplies or services including construction. This action is done by formal advertisement, negotiation, or other authorized methods of procurement. The CO makes written appointments of the COTR and administers contracts pursuant to law, FAR, NFS, and NASA policy.

5.5.5.2 The FPM should be prepared to assist the CO regarding pricing based on the analysis of the cost to be incurred. This effort involves performing an appraisal of expected future estimates of costs. Differences of opinion between the contractor and the CO may occasionally exist. This may not only be due to projections but also due to problems with the accounting techniques on which the costs are based. Compromises are, therefore, often necessary.

5.5.6 Solicitation.

5.5.6.1 The CO, with assistance from the FPM, must prepare a solicitation synopsis for release in the GPE. The synopsis describes the tasks to be performed and informs potential bidders that a solicitation for bids is forthcoming. The synopsis must appear in the GPE no less than 15 calendar days prior to the release of the solicitation to the bidders.

5.5.6.2 The solicitation shall be publicized through distribution to prospective bidders and posting in public places. Advertising the solicitation in the GPE and other media constitutes a public announcement. As discussed above, it is important that the solicitation be publicized in sufficient time to enable prospective bidders to submit responsive bids prior to the time set for public bid opening. For anticipated construction contracts, the GPE may be used to solicit industry comments that can assist in refining the project documents and the proposed solicitation.

5.5.6.3 Typically, discrete and minor facility projects requiring Headquarters approval may be synopsized in the GPE publications upon receipt of the Headquarters approval on the NASA Form 1509 or the specific authorization to proceed (see paragraph 5.3, Authority to Advertise).

5.5.6.4 Actual solicitation of the discrete or minor project bids cannot proceed until funds are made available on the purchase request in the amount of the Government estimate. Under some circumstances, the Headquarters Director, Facilities Engineering Division, may extend program approval to advertise for bids ahead of funding. However, actual issuance of the solicitation cannot proceed until the Center procurement officer has granted permission to release an un-funded solicitation. No award may be made without funds in the amount of the low responsive, responsible bid. Exceptions to these situations occur but strict rules apply. Therefore, obtain the advice of the CO when facts suggest that it is in the best interest of the Government to proceed with a solicitation short of obligation or that an award is appropriate ahead of full funding of the project.

5.5.6.5 The solicitation documents should describe the stated requirements clearly, accurately, and completely. Unnecessarily restrictive specifications or requirements may unduly limit the number of bidders and/or result in higher bids. The intent is to attract as many bidders as possible and achieve a low price by broad scale competitive bidding.

5.5.7 Potential Bidders/proposers, Onsite Visit, and Prebid/proposal Conference.

5.5.7.1 A prebid/proposal conference will also be held with the CO presiding. The FPM responsible for the project must then appraise prospective bidders/proposers of the work to be accomplished. If appropriate, this action would include an explanation of the role and significance of this project as part of other related work. Complex or unusual work items should be explained during this conference to minimize cost impacts caused by bidder/proposers uncertainty.

5.5.7.2 Bidders/proposers are urged and expected to visit the site where services are to be performed. However, site visits are not mandatory for awarding the contract. The objective is for them to get a thorough knowledge of the general and local conditions that may affect the cost of performance of the contract.

5.5.7.3 The CO evaluates questions raised by prospective bidders/proposers and provides answers by amendments if the solicitation documentation must be modified. The CO must coordinate technical questions with the FPM.

5.5.8 Receipt and Evaluation of Bids.

5.5.8.1 The FPM should be aware that the CO (or authorized representatives) will act as the bid/proposal opening officer. All unclassified bids must be publicly opened and recorded and will be read aloud to the persons present. Appropriate security procedures must be followed in instances where project work involves items that have been assigned a national security classification.

5.5.8.2 A record or abstract with the following information shall be completed by the CO or designee as soon as the bids have been opened and read:

a. Invitation number,

b. Bid opening date,

c. General description of procurement item,

d. Names of bidders,

e. Bid amount, and

f. Other information required.

5.5.8.3 All information shall be entered into the record and the bid opening officer must certify the accuracy of the record and, accordingly, it shall be available for public inspection.

5.5.8.4 Evaluation of the bids must be made by the CO and a panel assembled by the FPM who is responsible for the project.

5.5.8.5 The preservation of the integrity of the competitive sealed bid system dictates that award of contract must be made to the responsive, responsible bidder who submitted the lowest bid. Occasionally, a reason exists to reject all bids prior to contract award.

5.5.8.6 The CO is responsible for ensuring that the bids conform to the terms and conditions of the solicitation, determine responsibility, and determine responsiveness. The FPM serves as the technical advisor to the contracting officer in making these determinations.

5.5.8.7 An element of determining responsiveness is adherence to the Buy-American Act. The Act involves presolicitation and postbid opening decisions and an appropriate clause relative to the Act needs to be included in each solicitation (see Appendix E for details). Thus, if the FPM expects the project to contain non-domestic products, it is essential to advise the CO before the solicitation is prepared and assist with the analysis of bids regarding this matter after bid opening.

5.5.8.8 Facility Project Contract Bid Opening and Award Data. For all bid packages, the FPM must provide by data facsimile, NASA Form 1579, Flash Bid Report, (see the form and completion instructions in Appendix C, Forms and Instructions) to the Headquarters Director, Facilities Engineering Division, immediately following the completion of bid evaluation and a determination is made that the bids are responsive. In the event a determination of responsiveness cannot be made within 5 working days of the bid opening, a partial report will be submitted which provides the information available, reason for the delay, and description of corrective actions which the Center plans to pursue. NASA Form 1579, Flash Bid Report, needs to be submitted only for those projects whose total estimated cost exceeds $500,000. This report must be submitted regardless of the fund source or the type of contract used.

5.5.8.9 The CO shall make the final selection of a contractor in accordance with procurement laws and regulations. This action is based on the assessment and judgment that the prospective contractor can perform successfully. In this process, the following tools are used:

a. Preaward surveys and solicitations,

b. Debarred/suspended contractor list, and

c. Previous performance reports.

5.5.8.10 The preaward survey is an important tool for ensuring that the contract award will be made to an established contractor. A careful investigation should be made into the contractor's previous contracts as to responsiveness, responsibility, quantity of work previously subcontracted, financial stability, bonding capability, attention to health and safety of workers and the public, and other unique characteristics required for the project.

5.5.9 Receipt and Evaluation of Proposals. Proposals shall be received and evaluated in accordance with FAR Part 15and (NFS 1815), Contracting by Negotiation.

5.5.9.1 The FPM shall work with the CO in establishing the Source Selection Authority (SSA) at the lowest reasonable level for the acquisition in accordance with center procedures per the NFS 1815.

5.5.9.2 Following the evaluation process and selection of the contractor a NASA Form 1579, Flash Bid Report, shall be submitted to the Headquarters Director, Facilities Engineering Division, for those projects whose total estimated cost exceeds $500,000. The report will be filled out as though the proposals were bids.

5.5.10 Award of Contract. Prior to making the award, the CO will notify the FPM responsible for the project that the award will be made and when the preconstruction conference will be held. Award can be made after Center required concurrences have been obtained. This event may vary with different NASA Centers and type of contract. The CO makes award of the construction contract by written notice within the time for acceptance specified in the solicitation.

5.5.11 Preconstruction Conference.

5.5.11.1 The final step before the work can begin is the preconstruction conference that is chaired by the CO. The COTR may conduct the meeting. It should be held at the earliest possible date following the contract award. The purpose of the conference is to get the contractor and the subcontractor(s) started smoothly. Conference attendees are the Contractor, FPM, the designer who prepared the drawings and specifications, construction inspector(s), and other essential personnel. The list of attendees should

also include the lead designer and the lead construction manager as applicable. The contractor will then become familiar with key personnel, how they operate, and establish relationships between the different parties involved in the work.

5.5.11.2 Key matters that should be discussed and clarified during this meeting are as follows:

a. Administrative instructions, correspondence routing, and authorities that may issue orders to the contractor. (NASA policies on equal employment opportunity (EEO), cost accounting practices, and other items that may be required as part of the general instructions and conditions for the contract are provided as part of these instructions.),

b. Construction schedule submissions/updates and the sequence of work,

c. Methods of construction,

d. Shop drawing and other submittal review procedures,

e. Value engineering,

f. Testing requirements, agencies, or laboratories,

g. Long-lead time procurement items,

h. Requirements for equipment storage, maintenance areas, and material layout areas,

i. Human resources, shifts, and labor matters including work rules,

j. An acceptable Safety and Health Plan submission,

k. Contract modification procedures,

l. Supplier and subcontractor arrangements,

m. Progress and payment determinations,

n. Plans and specifications interpretations,

o. Site security, personnel badging, access limitations, and parking issues,

p. Sanitary facilities,

q. Construction utilities,

r. Environmental issues,

s. Access/outage requirements,

t. Housekeeping needs,

u. Maintenance manuals required,

v. Davis-Bacon Act requirements (see Appendix E for details),

w. As-Built requirements, and

x. Partnering.

5.5.11.3 Effective preparation for and conduct of this meeting can facilitate the establishment of harmonious relationships among the various elements throughout the life of the contract.

5.5.11.4 An agenda detailing the highlights of the meeting including specifications, page numbers, and other critical considerations should be prepared in advance of the meeting. The agenda serves as the basis for the minutes of the meeting.

5.5.11.5 An accurate written record of the preconstruction conference is required. The record may be determinative for contract administration, claims, and change matters. The record must be carefully prepared and concurred with by the FPM and the CO.

5.5.12 Partnering.

5.5.12.1 Partnering as defined in NFS Subpart 1836.70, Partnering, 48 CFR Chapter 18, means a relationship of open communication and close cooperation that involves both Government and contractor personnel working together for the purpose of establishing a mutually beneficial, proactive, cooperative environment within which to achieve contract objectives and resolve issues and implementing actions as required. The Partnering process builds a proactive team founded on honor in pursuit of mutual objectives, primarily safety, quality, schedule, budget, value engineering, and dispute avoidance. The team operates in an empowered, value-based, action-oriented environment geared for success.

5.5.12.2 A workshop, usually facilitated, is held initially to establish a partner relationship. The direction and synergism of the partnership is reflected in a charter mutually developed and signed by stakeholders. The charter contains a team binding message with clear, compelling objectives. The team develops helpful structures and systems to synchronize themselves for winning. During construction, the team periodically revisits the charter and frequently measures their progress against it. Quick action is taken to overcome problems or correct communication breakdowns. The net result yields higher quality products completed quicker at lower overall costs, with fewer accidents and no litigation.

5.5.12.3 The Partnering concept has spread rapidly throughout the design and construction business. The Associated General Contractors of America enthusiastically endorses the concept. The American Society of Civil Engineers believes Partnering is returning vitality to the American construction industry lost to adversarial relationships. Partnering is the management paradigm for construction of facilities within NASA (see NASA Partnering Desk Reference).

5.6 Construction Management Decisions and Actions

5.6.1 The construction phase brings to actual physical reality the prior efforts in the planning and budget process, design preparation, and construction contract award. The Center responsibility in this phase includes construction surveillance, funds management, cost control, and coordination to expedite the acceptance and activation of completed facility projects.

5.6.2 In the accomplishment of facility project work, it is essential that the construction contractor follow the approved contract drawings and specifications and adhere to the contract work schedule. This approach ensures that the work provides a complete and usable facility that satisfies the requirement that is the basis for the original project justification. The goal is timely completion of the facility within the approved cost estimate and in compliance with the contract documents.

5.6.3 Construction Surveillance. The responsibilities of the FPM for project work include administration and inspection of the construction effort.

5.6.3.1 The important element of the administrative responsibility is to have control over the flow, analysis, and preparation of the responses to correspondence from the contractor. Emphasis should be placed on providing prompt responses; and, when necessary, interim replies may be appropriate. These efforts involve the preparing and processing of status reports; reviewing and approving shop drawings and other submittals; processing contractor requests for progress payments and requests for information; and transmitting proposals concerning potential changes, requests for adjustment to the approved progress schedule, and other similar items.

5.6.3.2 Inspection includes the visual inspection of the construction operation (i.e., production and materials) whether onsite or offsite to ensure compliance with the terms of the contract. To assist the FPM in accomplishing these tasks, the construction management organization includes GFP managers, inspectors, engineers, architects, schedulers, analysts, and other specialists. At some of the NASA Centers, support contractors perform these functions. When the facility project documents are transmitted to the CO, one or more engineers are designated to perform the detailed Government inspection of the contract work. The FPM furnishes professional/technical advice to the CO; is responsible for the inspection of the contractor's work and interfaces with the contractor; provides engineering information; recognizes and takes action to correct improper construction work; initiates contract modifications; and establishes procedures to resolve field problems.

5.6.4 Facility Project Cost Control and Reporting.

5.6.4.1 The FPM's surveillance over facility project construction work includes the exercise of management and control of the costs for changes to the project work. A key element related to this is the maintenance of a project CCE highlighting approved and potential changes in the project cost and schedule. Particular emphasis must be placed on any changes that will require funds in excess of the approved amount to provide a complete facility.

5.6.4.2 Cost Control Sheet - a cost control sheet is required, as directed by Headquarters Director, Facilities Engineering Division, when a discrete project is segregated into separate work packages (see paragraph 4.2.1.2). The cost control sheet, depicted on Figure 5-2, Cost Control, when required is an attachment to the NASA Form 1509. It should be submitted to the Headquarters Director, Facilities Engineering Division, for approval at the time that the construction funds are requested.

5.6.4.3 The cost control sheet is designed to provide a reasonable level of program control while still allowing the Centers cost flexibility. This flexibility applies to the elements of a work package. It is possible to increase the cost of a work package provided the following apply:

a. The authorized physical scope and intent is not increased, and

b. The current cost estimate for the work package totals an amount not greater than the approved work package amount plus 10-percent or $250,000 whichever is smaller.

5.6.4.4 In the event the above conditions do not apply, the following options are available:

a. Submit a suggested revision to the distribution of the approved project amount as shown on the cost-control sheet. The redistribution can only be made on the basis of lowering the current cost estimate for one work package so that an increase can be made to the work package needing additional funds. In no case, can this be done arbitrarily but only on the basis of realistic current cost estimates.

b. If it is not feasible to redistribute, then consideration must be given to a scope redirection and recommendations should be made accordingly to the Headquarters Director, Facilities Engineering Division. Such proposals must be coordinated with the Headquarters Program Office prior to implementation.

c. In the event neither of the above two actions solve the problem, other appropriate actions will be considered by the Headquarters Director, Facilities Engineering Division, on a case-by-case basis.

5.6.4.5 It is readily seen that the validity of the current cost estimate is a key element to this total concept. For this reason, the cost control sheet is a tool, which must be realistically employed in the facility project management process.

5.6.4.6 A principal management tool for effective control of project costs during the construction phase is the systematic development and use of information on the physical and financial status of the project work. This effort is accomplished by establishing a system for tracking, analyzing, and reporting project costs; and identifying potential problems that could increase the project scope and cost and delay progress in the construction work.

Cost Control

Enter Project Title
Enter Center Name

Work Packages	**Program Plan**		**Funds Released**		
	AS OF:	THIS	THROUGH	THIS	TOTAL
Project No, *Enter Number* FY-*Enter Yr.*	*Enter Date*	REVISION	*Enter Date*	ACTION	TO DATE
Enter "WORK PACKAGE" *and Number Enter Descriptive Work Package Title*	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*
Enter "WORK PACKAGE" *and Number Enter Descriptive Work Package Title*	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*

Enter All Work Packages

CONSTRUCTION MANAGEMENT	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*
TOTAL	*Enter Total*	*Enter Total*	*Enter Total*	*Enter Total*	*Enter Total*

This PROGRAM PLAN column above lists the work package CCEs comprising the Approved Facility Project Cost Estimate (AFPCE). Project management flexibility is provided as follows: Work Package Funds released/realigned, listed in the TOTAL TO DATE column, may be varied to a maximum of 10-percent or $250,000 whichever is smaller provided the authorized scope of work as stipulated on the latest approved Form 1509, dated *Enter Date* , is not changed. This Cost Control sheet is an attachment to the Form 1509 referenced above and reflects current authorized funding agreements for each work package of the project.

CONCURRENCE: ____ APPROVED: ____

Design and Construction Team Date Code JX Date

Change No. *Enter No.*

Figure 5-2 Cost Control Sheet

5.6.4.7 Facility project cost control - the funding for the construction of an approved facility project is provided to the Center on the NASA Form 506A in accordance with the procedures described in paragraph 2.5.3, Facility Project Fiscal Management. This funding level establishes the following:

a. The basis for the facility project financial reports, and

b. The fiscal threshold for the management of the project CCE during the construction phase.

5.6.4.8 The project CCE that is developed for use during the construction phase must be derived from a professional engineering evaluation of the work to be accomplished and a realistic understanding of costs for this type of work at this location. Equally important is the constraint to do only work that is needed to meet the facility requirement and not to modify construction contracts to include additional work simply because it is desirable or funds are available. Continuation of cost control during construction is imperative to ensure that changes in total project costs do not exceed approved funds.

5.6.4.9 During the execution of the construction work, the FPM shall progressively analyze and refine the construction cost data and the project CCE. This must be done in comparison to the fiscal threshold established by the project funding provided in the NASA Form 506A and/or Form 800/01. For instances when an anticipated increase will result in a CCE that exceeds the funding provided, prior approval must be obtained from the Headquarters Director, Facilities Engineering Division. The action to request this type of increase in the project cost should provide the following information that is normally required as a part of the change control procedures identified in the project management plan:

a. A narrative justification, which identifies and describes the requirement for the work, which causes the cost increase,

b. A summary showing the major elements of the work and their costs that are the basis for the proposed increase in the project CCE,

c. A fiscal summary showing the amount of the basic construction contract plus the cost of all contract modifications, which incorporates previous approved change orders, and

d. A summary of outstanding changes not yet approved or negotiated and the estimated cost for each.

5.6.4.10 In all instances where an increase is proposed in the original project funding provided by NASA Form 506A, the additional work must be within the original scope of the facility project or be a change that has been approved by the Headquarters Director, Facilities Engineering Division.

5.6.4.11 Facility project reporting - during the actual construction, the reporting system provides an analysis of the current physical status and approved cost for the facility and a forecast of anticipated changes in cost. The FPM will establish internal facility project management and reporting procedures that assist the local project management effort and also provide source documents for both quarterly reports as well as the monthly reports on facility projects. See FPMS) for detailed instructions on the format, content, and submission schedule for the facility project status and financial data.

5.6.5 Material and Equipment Approvals.

5.6.5.1 The FPM and the inspecting staff are responsible for the technical evaluation and recommendations concerning the materials and equipment (shop drawings) proposed for use by the contractor. The CO has final authority for approval of this material and equipment and makes the decision on the basis of these recommendations.

5.6.5.2 Prior to the start of construction, the FPM must be satisfied that the contractor has an appropriate material test program that is consistent with the schedule for the actual construction work. This test program will be the principal means of determining that the materials and equipment, proposed for use by the contractor, are in compliance with the contract drawings and specifications.

5.6.5.3 Some of the items submitted to the COTR for approval may be samples from the manufacturer with certificates from the ASTM showing compliance with contract specifications. The FPM ensures that the certificates are submitted and approved by the COTR before any use of the material is made on the construction project. An exception would be ready-mix concrete where actual samples of the delivered material are tested. The equipment items are approved on a similar basis with the addition of an operating test and submission of the manufacturer's warranty.

5.6.6 Review and Approval of Shop Drawings.

5.6.6.1 The contract drawings or specifications indicate materials and equipment which require Government approval of the shop

drawings before the item is fabricated and incorporated into the facility. These shop drawings (actual drawings or catalog cuts) are prepared and submitted by the contractor for review and approval by the Government. The review must follow an established schedule so the fabrication and delivery of the item is consistent with the approved progress schedule for installing the item in the facility.

5.6.6.2 The FPM is responsible for scheduling a technical review of the shop drawings. Contractually, the approval of shop drawings is by the CO. In actual practice, this authority may be delegated in writing to the COTR who approves the shop drawings. In some cases the shop drawings may need to be reviewed by the A-E, which will increase the approval time and require a change to the construction schedule.

5.6.6.3 The FPM must ensure proper functioning of the shop drawing review system prescribed in the project management plan and take action as follows:

a. Allow sufficient time for adequate review,

b. Minimize the time required for transmitting the drawings,

c. Maintain current information on the status of the shop drawings submitted for review,

d. Coordinate with the contractor and applicable personnel on the unacceptable shop drawings or shop drawings having irregularities and/or disputes in order to minimize time delays, and

e. Identify and resolve instances where the shop drawing submission or review departs from the established schedule.

5.6.6.4 The contractor should submit shop drawings in accordance with the contract provisions as soon as possible after receipt of the Notice To Proceed (NTP). The review will be by the design engineer, occupational safety and health-related, safety and fire protection personnel, and other appropriate personnel. Where critical technical or operational considerations are involved, the users as specified in the management plan will make arrangements for a review. The contractor shall then acquire and install the required material and equipment in accordance with the approved shop drawings.

5.6.7 Project/Contract Modification Control.

5.6.7.1 The basic construction contract sets forth a scope of work with a price for that scope. After award, it may be necessary to modify the basic contract to accommodate scope revisions caused by field conditions or design changes. The designated CO is the only individual authorized to commit or execute such changes for the Government.

5.6.7.2 The process for obtaining changes includes identification, assessment, approval, and implementation. Details of the procedures to obtain approval/coordination are included in the management plan. Headquarters Director, Facilities Engineering Division, or designee approval/coordination is required for all of the following discrete project changes/impacts prior to contract modifications:

a. Changes to the approved scope of the project,

b. Causes of significant delays in scheduled milestone dates resulting in a programmatic impact,

c. Requirement for funds in addition to those approved by the NASA Form 506A for the project, and

d. Significantly changed (20 percent) funding level specified for individual elements of project work as specified in the 1510.

5.6.7.3 Cost changes are best controlled through development of firm requirements and clearly defined drawings and specifications and in the case of an RFP evaluation and negotiation.

5.6.7.4 NASA's normal policy disallows issuing construction contract modifications before formal negotiations are concluded. Exceptions are permitted in emergency situations where delays in issuing the modification would significantly impact the project schedule, cost, or operational support. In these cases, the FPM may direct the modification in advance of formal negotiations and documentation.

5.6.7.5 The processing of proposed changes to contracts for facility project work will normally follow the guidance and direction provided to the FPM by the CO and Headquarters. This guidance provides the FPM with the basis for developing specific change order control procedures for the facility project management plan. The first step is usually the preparation of an assessment of the proposed change covering the following:

a. The advisability of accomplishing this work as a change to the basic contract. This includes inputs from the engineering staff, schedule analysts, and other appropriate personnel/activities.

b. A detailed Government cost estimate covering material, labor, and other elements.

c. Time and cost impacts to accomplish the work included in the change and the potential impacts to ongoing work. Of special concern is work that has an impact on the approved progress schedule.

5.6.7.6 Subsequent steps involve the review and assessment made by either the Change Control Board (CCB) or by designated individuals. Following the review, the CO shall request the contractor to submit a proposal to accomplish the change. The FPM and others will evaluate the contractor's proposal and the completed evaluation will be provided to the CO (see Figure 5-3, Typical Change Order Procedure, for details).

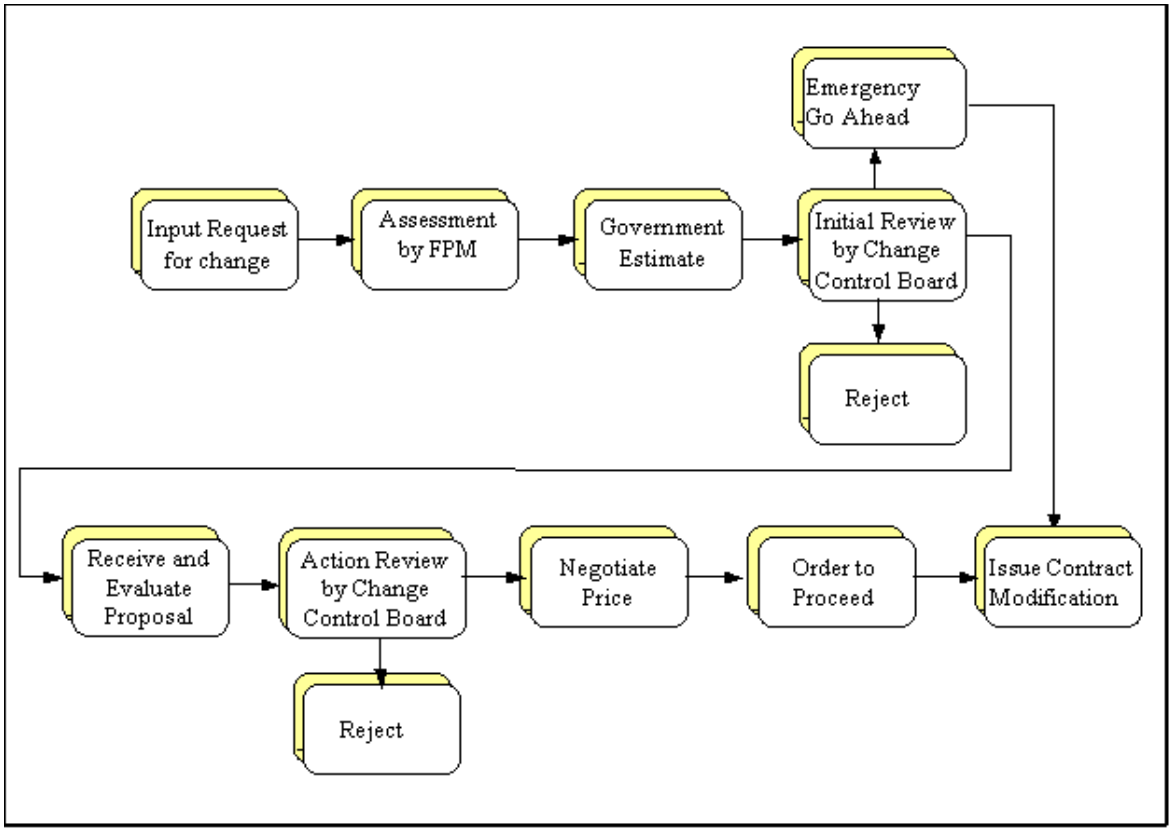

Figure 5-3 Typical Change Order Procedure

5.6.8 Network Planning and Analysis. The management of facility project work requires the use of a plan of execution showing the component activities, the work duration, and the sequence of events and milestones for the completion of various elements of work. This plan provides a schedule showing the start and completion of individual elements of work and interior milestones (i.e., benchmarks that identify interfaces with other NASA activities; establish the physical status of the work; and measure progress towards meeting the approved schedule for occupancy, completion, and activation of the facility). Network diagrammatic scheduling such as the CPM is a technique presently available for the planning, evaluation, and control of construction activity. (Note: A full discussion of networking techniques is beyond the scope of this text and a number of excellent references are available.)

5.6.9 Progress Control and Payments.

5.6.9.1 The contractor's cash flow and financing costs depend on progress payments. When the contract clearly specifies that progress payments will result only from work accomplished in accordance with the mutually agreed upon schedule as shown in the network diagram, the contractor will be motivated to do the following:

a. Keep the execution plan and schedule updated and furnished to the FPM on a regular basis, and

b. Follow the plan and schedule with a minimum of deviation in order to satisfy the critical interior milestones for interface with other activities.

5.6.9.2 Tracking actual work progress versus planned work is a combination of day-to-day physical inspections and regular (at least weekly) discussions with the contractor. The physical inspections should not be limited to the construction site alone if offsite fabrication or acceptance testing is part of the plan. Actual offsite inspection of progress is most important if a task on the critical path is dependent on the offsite activity for timely accomplishment. The tracking of the physical progress in accomplishing the contract work shall include tracking and analysis of the composition and size of contractor workforce present at the job site(s). Worker loading information provides an indication of progress by staff hours and dollars expended. The daily inspections should not simply tabulate what is in place but should also identify planned activity that is not occurring.

5.6.9.3 Proper use of progress payments is essential to avoid contractual problems. The FPM must ensure that the payments accurately reflect the percentage of work actually completed. In general, payments should only be authorized for material and equipment after it is installed. However, if an agreement exists to pay for materials and/or equipment when it is delivered on site, the contractor shall provide adequate protection and storage for the items. The Government may also pay for materials and equipment delivered to the contractor at other locations if the specific conditions listed in FAR Clause 52.232-5, Payment Under Fixed-Price Construction Contracts, are met. Note: A significant amount of funds (e.g. 5 percent) should be retained until the work has been accepted.

5.6.9.4 Additionally, FAR Clause 52.232-5, requires the contractor to submit a certification stating that payments have been made to subcontractors and suppliers from previous payments and timely payments will be made from the proceeds to this payment. Any amounts withheld from the subcontractor or supplier by the contractor in accordance with the subcontract should not be billed to or paid for by the Government. If the contractor does not complete the certification, then payment should not be made.

5.6.9.5 Accurate, certified payroll records should be received at least monthly from the contractor and each subcontractor onsite. These records shall be reviewed to verify the crew sizes, dates of work, and wages. Any discrepancies must be brought to the attention of the CO.

5.6.9.6 Periodic, at least monthly, review meetings should be held with the construction contractor as follows:

a. The format of these meetings should be that of a formal dialogue beneficial to both parties. The FPM should schedule and chair the sessions. Attendance should include the contractor's representative who can authoritatively answer questions about day-to-day planning and progress.

b. Having a comprehensive inspection diary, the FPM can enter the review discussions each week with a meaningful agenda.

c. The discussions should start with the contractor providing answers to unresolved questions from the previous meeting plus any inputs on the current planning activity that deviates from the approved schedule.

d. The FPM should advise the contractor of those items of work which can be authorized for progress payments based on their apparent contribution to maintaining the approved schedule as shown on the network diagram.

e. Next the FPM should ask any questions arising from inspections, discuss recovery plans for deficient items on the critical path, and ask any questions about work planned for the immediate future.

f. The minutes of these meetings should be prepared and provided to all participants as soon as possible after the meeting. The purpose is to assist in providing effective future direction and to ensure timely followup action.

5.7 Construction Project Operations and Maintenance (O&M) Considerations

Facility projects at Centers are frequently complex and include extensive specialized equipment. For such projects, it is essential that arrangements be made for preparation of instructions, training of personnel, and provision for spare parts and special tools needed to operate, maintain, and repair the facility and the utility support systems. The arrangements to develop this capability are usually done in parallel with the associated design and construction effort.

5.7.1 O&M Instructions and Manuals. The Center responsible for the construction of a major facility must arrange for the development of the O&M instructions or manuals. Usually, this is an effort that extends through the design and construction phases. Provision should be made in the A-E and/or construction contract to develop the O&M instructions and provide these in electronic form as part of the completed facility project including items such as--

a. Detailed maintenance procedures,

b. Detailed operational procedures,

c. Detailed system checkout instructions and periodic tests,

d. Master equipment list,

e. Spare parts list,

f. Special tool list,

g. Additional data required to populate the Center's CMMS, and

h. Test data from the PT&I and conventional acceptance testing.

5.7.2 Training O&M Personnel. The FPM ensures that O&M personnel receive training in operating and maintaining the facility and equipment. The training must be accomplished before the final acceptance of the facility. The O&M manuals should also be provided to personnel at the same time they receive training on the equipment.

5.7.3 Spare Parts and Special Tools. When required by the contract specifications, the CO will ensure that the contractor delivers these parts and tools by the final acceptance date.

5.7.4 Operation and Maintenance Contracts. A Center should consider whether their existing or planned O&M contract includes the work required to operate and maintain the new facility. Changes to the O&M contract may be required and in the case of a large or highly technical facility it may be appropriate to consider a separate contract for all or elements of the facility.

5.8 Construction Contract Completion and Acceptance

5.8.1 Facility Systems Tests. During the course of new construction, major repair, or rehabilitation of facilities, it is not unusual to discover installed systems and equipment that contain latent defects due to manufacturing and/or installation practices or do not operate per design. System or equipment defects result in premature failures and increased O&M cost; therefore the inspection of the facility should verify that systems and equipment meet design requirements prior to acceptance of the facility from the contractor and the contractor's departure from the job site. By using available PT&I technologies (see NASA's Reliability Centered Building and Equipment Acceptance Guide combined with thorough baseline and installation/ manufacturer documentation and traditional operational parameters, acceptance testing will reduce premature failures, increase safety and reliability and decrease life-cycle costs. Typical PT&I technologies used during acceptance testing include, but are not limited to, vibration analysis, oil and hydraulic fluid analysis, temperature monitoring, airborne ultrasonics, electrical system testing, and fluid flow and process analysis. Final test results must be documented and provided to the O&M organization for use as baseline data.

5.8.1.1 Subsystem Tests. Subsystem testing is required to identify latent defects and to ensure that parts of the facility systems or standalone subsystems are functioning properly and within specifications prior to a full integrated systems test. Examples may be (1) testing and operating air handling units, chillers, and water pumps prior to integrating their operation with the facilities control system; (2) testing and operating a lubrication oil system for a new wind tunnel drive system; and (3), testing high voltage cable insulation prior to system energizing. Test plans are usually written to provide guidance during testing. A record of test results should be maintained and provided to the O&M organization for future reference. The plans must include the use of Reliability Centered Building and Equipment Acceptance (RCBEA) utilizing PT&I technology as described in NASA's Reliability Centered Building and Equipment Acceptance Guide where applicable. Subsystem test plans can be as simple or complex as required depending on the complexity and interaction of the test parameters.

5.8.1.2 Integrated Systems Test. The integrated systems test (IST) is an end-to-end complete test of a total system. Examples are (1) startup, verification of all operating parameters, and shutdown of a new wind tunnel; (2) testing of a fire detection and protection system for a new facility; and (3), operational testing of a digitally controlled facility air conditioning system. Test plans

can be simple to very complex as in the case of a wind tunnel IST. Records of the test results must be maintained and provided to the O&M organization for future reference.

5.8.2 Prefinal Inspection.

5.8.2.1 When the FPM considers the work to be substantially complete, arrangements must be made to inspect the facility in advance of the scheduled final completion date. The FPM, the assigned inspector, the contractor, safety and/or occupational health representative as appropriate (per NPR 8715.3, NASA Safety Manual and NPD 1800.2, NASA Occupational Health Program), and other appropriate personnel shall make the pre-final inspection. The objective of this inspection is to identify defects and deficiencies and schedule the necessary corrective work. In conducting the prefinal inspection, the FPM shall verify that appropriate systems tests have been performed (see paragraph 5.8.1, Facility Systems Tests) and the construction is in accordance with the contract drawings and specifications and should:

a. Identify and highlight those defects that could delay the installation of critical mission equipment, and

b. Identify instances when defects and faulty production would impose undue additional expense.

5.8.2.2 All of the deficiencies identified in this prefinal inspection must be recorded and furnished to the CO and the contractor.

5.8.2.3 The contractor must develop a schedule for the work to correct these deficiencies; and, after approval, shall provide a copy of the schedule to the FPM. The contractor shall correct these items and with the FPM and the assigned inspector verify their completion. It may be necessary to repeat this effort several times. When the FPM is satisfied that the deficiencies have been corrected, the final inspection can be scheduled.

5.8.3 Final Inspection.

5.8.3.1 The COTR shall establish the date for the final inspection. The FPM shall notify all agencies and organizations that have a need to participate in the final inspection of the facility. The size of the inspection group should be held to the minimum but should include the following:

a. CO,

b. FPM,

c. Project inspector,

d. User organization representative,

e. Safety and/or occupational health representative as appropriate, and fire protection representatives (per NPR 8715.3, NASA Safety Manual),

f. Representative of the Center O&M activity,

g. Contractor's representative, and

h. Other essential representatives.

5.8.3.2 If appropriate, manufacturer's representatives for major equipment items, Center operation and maintenance personnel, and representatives of other activities involved in the future operation of the facility should also be available.

5.8.3.3 The actual inspection tour will follow an established schedule; and, prior to the inspection, each member of the group may be provided with a list of the items that were corrected during prefinal inspections. The final inspection shall generally include the following:

a. A tour of the entire facility project,

b. Verification of corrections of previously identified deficiencies,

c. Inspection of contractor work. Contractor installed equipment should be operating or started and controls made to function,

d. Identification of systems that are to be tested and inspected at a future date because of weather or other conditions, and

e. Identification of construction deficiencies not previously identified.

5.8.4 Acceptance of Facilities.

5.8.4.1 The report of the facility project final inspection shall provide the status of each major system or subsystem which is part of the project. The status shall include a schedule of all future tests and inspection of equipment not inspected due to lack of actual operating conditions. Also included shall be a schedule for the correction of any remaining construction deficiencies. As part of the process of final inspection, the FPM may make arrangements for the user to have access to the facility. This normally constitutes beneficial occupancy of the facility and the FPM shall establish the conditions and schedule under which personnel and organizations may occupy and use the facility.

5.8.4.2 The transfer of a facility project to NASA custody will be completed within 60 days after completion of the final acceptance inspection. The following are part of this process:

a. The O&M organization, in concert with the using activity, should assume the responsibility for the operation and maintenance of the facility and shall provide other than CoF resources for this work, and

b. The FPM shall prepare and forward to the Center real property accountability officer, the following:

(1) For work accomplished by a contractor or NASA personnel, a NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property, and

(2) For work accomplished by the Department of Defense, a DOD Form 1354, Transfer and Acceptance of Military Real Property.

5.8.4.3 The type of acceptance (i.e., full or limited) that is used will depend upon the circumstances at the time that NASA assumes custody of the facility. A full discussion of types of acceptance and instructions on the uniform procedures for physical accountability, recording, and reporting of real property is provided in NPR 8800.15A, Real Estate Management Program Implementation Manual.

5.8.5 Record Drawings. If required by the contract, the FPM shall have available from the contractor a set of contract drawings on which all changes have been recorded. These drawings are the basis for development of as-built record drawings for the facility. Record drawings are required for each facility project and can be provided as part of the construction contract or as engineering services by the designer.

5.8.6 Warranties/Guarantees. The CO shall ensure that the warranties and guarantees fully cover all of the conditions stated in the contract documents. The contractor guarantees production equipment or material for the terms specified in the construction document after the Government accepts the facility. The warranties on equipment begin when the equipment is accepted and must clearly state the responsibilities of the manufacturer and installation contractor. In those instances when it is necessary to delay the test and inspection for certain items of equipment, the CO, contractor, FPM, and Center maintenance activity will establish the responsibility for the equipment while awaiting acceptance of the real property accountability for the facility and equipment. The local facility maintenance activity shall establish procedures to ensure that the terms of the warranties and guarantees are exercised if necessary.

5.8.7 Latent Defects. Latent defects may be present. In general, the standard or test for latent defects is the defect must have been present before acceptance of the product by the Government and the defect could not have been discovered through reasonable inspection. Therefore, initial decisions by the FPM, in conjunction with the A-E, if appropriate, regarding the type and nature of acceptance testing and criteria are important. It is also important to keep in mind that excessive inspection is paid for by the Government. Appropriate attention to recordkeeping is essential. Historically, any claim for relief by the Government under the latent defects principle has been contentious and difficult.

5.8.8 Final Contract Closeout.

5.8.8.1 The FPM is responsible to ensure customer satisfaction along with meeting the stated objectives of scope, schedule, and budget.

5.8.8.2 The FPM can continually improve future performance by soliciting feedback from customers via a questionnaire shown in Figure 5-4, Facility Project Management Questionnaire.

5.8.8.3 The CO, assisted by the FPM, shall accomplish final contract closeout. This is done in the following two steps:

a. First, following the closeout of changes and claims, it is necessary to complete SF 1420 Performance Evaluation - Construction Contracts. Past performance records, aside from being a requirement, facilitate evaluation of future bids and is more precise. Thus, adequate project records must be maintained with this purpose in mind as well as for day-to-day management of the project work.

b. Second, the CO shall assemble the final file records and store them pursuant to the FAR and other records management guidance. These two steps shall be accomplished within 90 days of final inspection.

5.8.8.4 To avoid or reduce the potential delay in contract fiscal completion from contractor claims, the CO and the FPM must have adequate records of the contract work. These records should include all proposed and approved contract modifications, status of prior contractor claims, and other materials that can be used to assist in the prompt establishment of the Government position on a contractor's claim. During the performance of the contract work the following action should be taken:

a. Ensure the project inspector's log is complete and accurate and covers all construction activities on the project,

b. Maintain accurate records of modifications to the basic contract that incorporate approved change orders,

c. Record all official communications with the contractor,

d. Receive current as-built construction drawings which cover all the work accomplished under the contract, and

e. Emphasize the followup on the correction of construction defects and deficiencies identified during the prefinal and final inspection.

FACILITY PROJECT MANAGEMENT QUESTIONNAIRE

The Facilities Project Manager requests your participation in our efforts to improve our services by completing this questionnaire.

Project Description: _____	Control Number: _____
Location: _____	Project Manager _____
Date: _____	

For Customer Use	Yes	No
Were you involved in every step of the project (i.e., from inception to completion)?		
Did the work performed satisfy your requirements (function, quality, timeliness)?		
Was the project manager readily available and responsive during the course of the project?		
Did the project manager resolve your concerns to your Satisfaction?		

Remarks: _____

Figure 5-4 Facility Project Management Questionnaire

5.8.8.5 When agreement is not reached through normal negotiations, the construction contractor may submit a claim to the CO who has the authority to establish the Government position on the claim. With proper Government records, the evaluation and processing of contractor claims can be expedited and the Government position quickly established. The Government records provide the basis for action on the claim by the CO and, in the event the action is referred to Headquarters, the data are on hand for forwarding with the claim. After the claim is ruled upon, the contractor has 90 days to file a written appeal to the NASA Board of Contract Appeals or 12 months to appeal through a U.S. Claims Court.

| TOC | Preface | Chapter1 | Chapter2 | Chapter3 | Chapter4 | Chapter5 | Chapter6 | AppendixA | AppendixB | AppendixC | AppendixD | AppendixE | AppendixF | AppendixG | AppendixH | image022 | image023 | Image3-1 | Image_G-1 | ALL |

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